



Handbook for Traffic Control In Construction & Maintenance Areas

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Preface

This is a booklet for maintenance employees of Indiana's local roads and streets. It is intended to be carried by the maintenance crew into the field as a ready reference to assist in setting up the traffic control. Safety of the maintenance crew and of those who are travelling on the facility is essential.

Indiana follows a statewide method of controlling traffic. This agrees in nearly all ways with a national policy and it is called the Indiana Manual on Traffic Control Devices for Streets and Highways. This booklet follows all recommendations found in the manual but is in a form to be convenient to the maintenance employees.

In most situations this book will give you the answers but when questions arise be sure to ask your supervisor.

Protect yourself, your neighbors and your job --
PRACTICE SAFETY.

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TRAFFIC CONTROL IN CONSTRUCTION & MAINTENANCE AREAS ON TWO-LANE TWO-WAY ROADWAYS

The purpose of this handbook is to provide information and guidelines to those persons involved in providing traffic control devices to warn and guide motorists and pedestrians in construction and maintenance areas on two-lane two-way roadways. This handbook is to serve as a supplement to the *Indiana Manual on Uniform Traffic Control Devices for Streets and Highways*.

The following is taken from State of Indiana Statute 9-4-2-1 section 1: "*The Indiana Manual on Uniform Traffic Control Devices for Streets and Highways* shall be adhered to by all governmental agencies within the state responsible for the signing, marking, and erection of all traffic control devices on all streets and highways within the state." Copies of the Manual can be obtained from the Indiana Department of Highways, Room 1313, Indianapolis, Indiana 46204: Attention - Contracts Engineer. A copy of the Manual is on file in each county courthouse in the state.

Another publication that can be very useful is *Work Zone Traffic Control Standards and Guidelines - 1985 Edition*. The booklet is Part VI, Traffic Controls for Street and Highway Construction and Maintenance Operations of the *Manual on Uniform Traffic Control Dev-*

ices and Part VI, Work Zone Traffic Control, of the *Traffic Control Devices Handbook*. Copies of the booklet can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. The stock number is 050-001-00290-6. The price is \$2.75. Copies can also be obtained by calling the GPO Chicago Store at 312-353-5133.

Responsibility for Safety on Highways

The responsibility for the safety of the public using a public roadway as well as the safety of workers rests with the unit of government which has operational control over the street or highway. This means that regardless of whether work is performed by governmental agency personnel, by a private contractor, or by a public utility company, the governmental unit having jurisdiction (i.e., city, town, county, special authority, or state) is ultimately responsible for the safety of the public. This does not mean that the supervisor of the construction or maintenance activity or the workers involved with the job are relieved of responsibility for the safety of the public. They are also responsible. The control of traffic in a construction or maintenance area is called a ministerial task. Highway departments, employees, and others involved in construction or maintenance who do not follow the provisions in the MUTCD are very likely to be held liable for negligence in the instance of accidents occurring in construction or maintenance areas.

Highway personnel should anticipate the likelihood of lawsuits in the event of an accident. To prevent or minimize such litigation and to help defend lawsuits, the following is recommended:

- Know and comply with the traffic control for street and highway construction and maintenance operations set forth in the State MUTCD and nationally accepted engineering standards and practices.
- Provide properly working devices at the site particularly when unattended (nights, weekends, etc.).
- Document all actions taken on or related to traffic controls that are placed in effect at the worksite.
- Inspect the worksite at frequent intervals with a view to detecting and immediately correcting deficiencies in traffic control.
- Remove all material and equipment not needed at the site as soon as possible (this applies also to traffic control devices that cease to be needed).
- Provide warning and protection to motorists, pedestrians, and workers for potential conflicts and hazards that may result from work being done at the site.

Goals and Principles of Traffic Control in C/M Areas

Goals common to all traffic control zones in construction and maintenance areas are to minimize accidents and accident severity and to minimize inconvenience to and conflicts with motorists and pedestrians as a result of

construction and maintenance work within the roadway.

Construction and maintenance areas can present motorists with unexpected or unusual operational situations. It is necessary to take special care in applying traffic control techniques in these areas. Do not surprise the motorist. Do not assume that motorists and pedestrians will see or recognize workers or hazards in work areas.

Traffic should be inhibited as little as possible. It should be guided in a clear and positive manner while approaching and passing around or through construction and maintenance areas. Positive guidance means telling the motorist in clear unmistakable terms what path to follow and what speed to drive. This guidance is provided by using standard traffic control devices such as signs, markings, and channelizing devices which are effective under varying conditions of light and weather to alert motorists to impending conditions, warn them of the hazards and direct them through the proper path. The standard traffic control devices are specified in the *Manual of Uniform Traffic Control Devices*.

Traffic safety in construction zones should be an integral and high priority element of every project from planning through design and construction. Also maintenance work should be planned and conducted with the safety of the motorist, pedestrian and worker kept in mind at all times.

Traffic control should permit the safe and efficient movement of traffic through the construction or maintenance zones and at the same time provide a safe area where construction or maintenance activity can be conducted efficiently.

Procedure for Controlling Traffic in Construction and Maintenance Areas

The procedure for controlling traffic in construction and maintenance areas includes the following:

- planning and design
- installation
- inspection and maintenance
- removal

Planning and Design

A traffic control plan, in detail appropriate to the complexity of the work project, construction or maintenance, should be prepared. Before going to the work site, a plan should be prepared to determine the type and number of traffic control devices (signs, barricades, cones, etc.) that will be needed to safely control the traffic.

No one standard sequence of signs and/or other traffic control devices can be set up as an inflexible arrangement for all situations due to the variety of conditions that can be encountered in the field. The unique condi-

tions of each site must be evaluated. Typical layouts as illustrated in the included examples provide a good starting point but often require modification if they are to function properly. Examples provided are minimum desirable standards for normal situations. Additional protection must be provided when special conditions and hazards exist.

The system of traffic control devices, signs, markings, channelizing devices (barricades, cones, etc.) warn the motorist of presence of workers and equipment, warn of changes in road alignment and cross section, road surface condition or roadside features due to construction or maintenance activities, warn of nature or extent of special hazards, and safely guide the road user through the work area.

A typical traffic control device plan will include an advance warning area where the motorist is told there is construction or maintenance activity ahead, an approach area where the motorist is informed as to a safe speed and travel path to follow, the actual work area where the proper path for traffic around or through the construction or maintenance activity is delineated, and the downstream area where the motorist is told that the construction or maintenance area has ended. See Figure 9.1.

When selecting traffic control devices (signs, markings, channelizing devices) it is very important to use standard devices as to shape, size, color, message, as illustrated in the *Indiana Manual on Uniform Traffic Control Devices*. Typical examples are given in

Figures 9.2 through 9.9. Warning signs in construction and maintenance areas shall be diamond shaped (square with one diagonal vertical), having a black symbol or message on an orange background. Any traffic control devices that are to be used at night must be reflectorized. Since most traffic control devices may be used at one time or another at night it is best to have all signs, markings, and channelizing devices reflectorized.

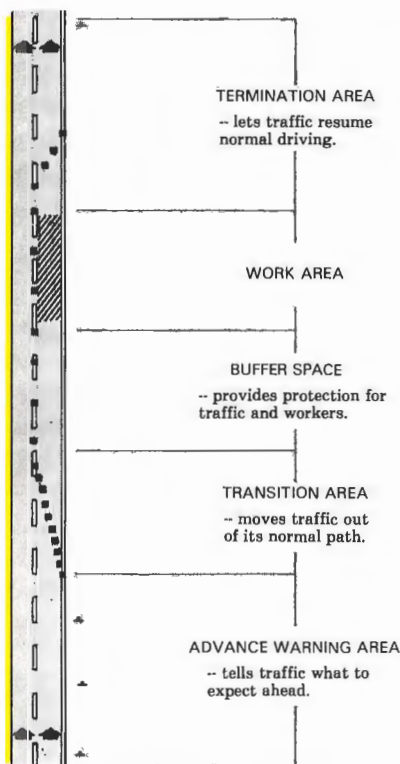


Figure 9.1: Areas in a Traffic Control Zone. [9-2]

In Indiana there are several suppliers who are familiar with the standards for traffic control devices and can provide signs, marking materials and channelizing devices that comply with the *Indiana Manual on Uniform Traffic Control Devices*. Contact the Indiana Department of Highways for names of these suppliers. Do not use "nonconforming" home made signs.

Channelizing devices are traffic control devices used as part of a traffic control system to warn and alert motorists of hazards created by construction or maintenance activities in or near the traveled way, and to guide and direct the motorist along a path safely past the hazards. Channelizing devices includes cones, vertical panels, drums, barricades, and barriers. See Figure 9.9. Cones shall be a minimum of 18" in height. On high speed roadways and on all facilities during hours of darkness or whenever more conspicuous guidance is needed, a minimum cone height of 28" is preferable. Drums shall be approximately 36" in height and a minimum of 18" in diameter. Type I and II barricades are a minimum of 3 feet high. Markings for barricade rails shall be alternate orange and white stripes (sloping downward at an angle of 45 degrees in the direction traffic is to pass). All channelizing devices should be constructed so as not to inflict any undue damage to a vehicle that inadvertently strikes them. Where barricades may be susceptible to overturning in the wind, sandbags should be used for ballasting. Sandbags may be placed on lower parts of the frame or stays to provide the required ballast but shall not be placed on top

of any striped rail. Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to motorists. When used in the winter, they should have drain holes in the bottom so water will not accumulate and freeze.

Advance Road (Street) Construction Sign

(XW20-1): The Advance Road (Street) Construction sign is to be located in advance of the initial activity or detour a driver may encounter, and is intended for use as a general warning of obstructions or restrictions. It carries the legend ROAD (STREET) CONSTRUCTION (1500) FT or ROAD (STREET) CONSTRUCTION (1/2) MILE, or ROAD CONSTRUCTION AHEAD. It may be used in repetition with appropriate legends, or in conjunction with other construction signs.



XW20-1
48" x 48"



XW20-1a
48" x 48"
Line 1--8"-C
Line 2--8"-C
Line 3--6"-C
Line 4--6"-C



XW20-2
48" x 48"



XW20-2a
48" x 48"
Letters 8"-D

Advance Detour Sign

(XW20-2): The Advance Detour sign is intended for use in advance of a point at which traffic is diverted over a temporary roadway or route. It carries the legend DETOUR (1500) FT or DETOUR (1/2) MILE, or DETOUR AHEAD. It may be used with repetition with appropriate legends or in conjunction with other construction signs.

Figure 9.2: Warning Signs Used in Construction or Maintenance Areas. [9-1]

Advance Road (Street) Closed Sign (XW20-3):

The Advance Road (Street) Closed sign is intended for use in advance of a point at which a roadway is closed to all traffic or to all but local traffic. It carries the legend ROAD (STREET) CLOSED (1000) FT or ROAD (STREET) CLOSED (1/4) MILE, or ROAD (STREET) CLOSED AHEAD. It may be used in repetition with appropriate legends or in conjunction with other construction signs.



XW20-3
48" x 48"

Advance One Lane Road Sign (XW20-4):

The Advance One Lane Road sign is intended for use only in advance of a point where traffic both directions must use a single lane. It carries the legend ONE LANE ROAD (1000) FT or ONE LANE ROAD (1/4) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.



XW20-4
48" x 48"

If the one-lane stretch is of such length as not to be visible throughout from either end, or if the traffic is of such volume that simultaneous arrivals at both ends occur frequently, provision should be made to permit traffic to move alternately under control.

Figure 9.3: Warning Signs Used in Construction or Maintenance Areas. [9-1]

Advance Flagger Sign (XW20-7): The Advance Flagger sign is intended for use in advance of any point at which a flagger has been stationed to control traffic through a construction or maintenance project. It carries the flagger symbol. When needed, an appropriate distance message may be displayed on a supplemental plate below the symbol sign. It may be used in repetition with appropriate revisions in the supplemental distances plate or in conjunction with other construction signs.

The word message sign XW20-7 with appropriate distances may be used as an alternate to the XW20-7a flagger symbol sign.

The sign shall be promptly removed, covered, or turned to face away from the roadway whenever the flagger is not at the station.

TWO-WAY TRAFFIC Sign (XW6-3): TWO-WAY TRAFFIC sign should be used as needed at intervals to periodically remind drivers that they are on a two-way highway which contains opposing traffic. The word message TWO WAY TRAFFIC may be used as an alternate to the symbol sign.



XW20-7
48" x 48"



XW20-7a
36" x 36"



XW6-3
48" x 48"



XW6-3a
48" x 48"
Letters 8"-C

Figure 9.4: Warning Signs Used in Construction or Maintenance Areas. [9-1]

Worker Sign (XW21-1): A Worker sign is intended for use in conjunction with minor maintenance and public utility operations for the protection of workers in or near the roadway. On low-speed urban roads a worker sign is intended for use at limited obstruction sites which are adequately marked and clearly visible, such as an open manhole with a fence around it. The XW21-1 word message sign may be used as an alternate to the XW21-1a Worker Symbol sign.



XW21-1
36" x 36"



XW21-1a
36" x 36"

FRESH OIL Sign (XW21-2): The FRESH OIL (TAR) sign is intended for use to warn motorists that resurfacing operations have rendered the surface of the pavement temporarily hazardous, and that objectionable splashing on vehicles may occur.



XW21-2
30" x 30"

ROAD MACHINERY Sign (XW21-3): The ROAD MACHINERY sign is intended for use in areas where heavy equipment is operating in or adjacent to the roadway.



XW21-3
36" x 36"

ROAD WORK Sign (XW21-4): The ROAD WORK sign is intended for use in advance of maintenance or minor reconstruction operations in the roadway.



XW21-4
36" x 36"

Figure 9.5: Warning Signs Used in Construction or Maintenance Areas. [9-1]

SHOULDER WORK Sign (XW21-5): The SHOULDER WORK sign is intended for use in advance of maintenance or minor reconstruction operations involving the shoulder, where the traveled way remains unobstructed.



XW21-5
30" x 30"

SURVEY CREW Sign (XW21-6): The SURVEY CREW sign is intended for use in advance of a point where a surveying crew is working in or adjacent to the roadway.



XW21-6
30" x 30"

Length of Construction Sign (XG20-1): The Length of Construction sign is for use at the limits of any road construction or maintenance job of more than 2 miles in extent, where Traffic is maintained through the job. It carries the legend ROAD CONSTRUCTION NEXT (5) MILES. It can be effectively mounted on a wing barricade. This sign may be used where required, for jobs of lesser length or on urban streets with appropriate distances shown.



XG20-1
60" x 36"

END CONSTRUCTION (ROAD WORK) Sign (XG20-2): The END CONSTRUCTION (ROAD WORK) sign should be erected approximately 500 feet beyond the end of a construction or maintenance job.



XG20-2
60" x 24"

Figure 9.6: Warning Signs Used in Construction or Maintenance Areas. [9-1]

It may be erected on the back of a warning sign set up facing the opposite direction of traffic or on the back of a wing barricade. Where appropriate, the legend END ROAD WORK may be used.



XG20-2a
80" x 24"

Detour Signs and Markers (XM4-8, 9 and 10): The Detour Arrow sign (XM4-10) is used at a point where a detour roadway or route has been established due to the closure of a street or highway to through traffic. It should normally be mounted just below the ROAD CLOSED sign or the Local Traffic Only sign.



XM4-10 (R or L)
48" x 18"

The Detour Arrow sign uses a horizontal arrow pointed to the right or left as required at each location.

Each detour shall be adequately marked with standard temporary route markers and destination signs as a responsibility of the highway agency. The Detour marker (XM4-8) mounted at the top of a route marker assembly is to be used to mark a temporary route that branches from a regular numbered route, bypasses a section of a route which is closed or blocked by construction, major maintenance, roadway damage or traffic emergency.

Figure 9.7: Warning Signs Used in Construction or Maintenance Areas. [9-1]

and rejoins the regularly numbered route beyond that section. The Detour sign (XM4-9) is to be used for unnumbered routes; for use in emergency situations; for periods of short durations; or where, over relatively short distances, it is not necessary to show route markers to guide traffic along the detour and back to its desired route.



XM4-9 (R or L)
30" x 24"



X W1-1
30" x 30"



X W3-2
36" x 36"



X W4-2
36" x 36"



X W1-2
30" x 30"



X W5-1
36" x 36"



X W8-1
30" x 30"



X W1-3
30" x 30"



X W5-2
30" x 30"



X W8-2
30" x 30"



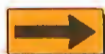
X W1-4
30" x 30"



X W5-3
36" x 30"



X W8-3
30" x 30"



X W1-6
48" x 24"



X W9-2
36" x 30"



X W8-4
30" x 30"



X W3-1
36" x 36"

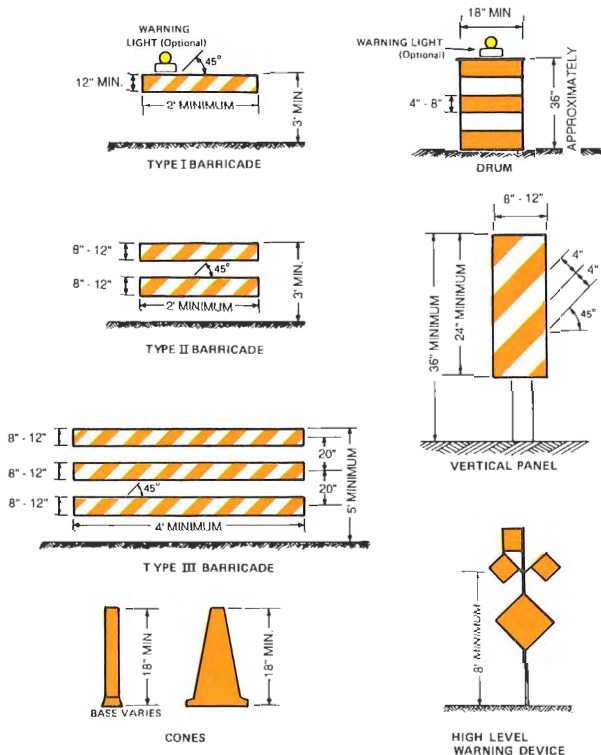


X W9-1
30" x 30"



X W8-5
30" x 30"

Figure 9.8: Warning Signs Used in Construction or Maintenance Areas. [9-1]



NOTE:

Flashing or steady burn warning lights should be used on barricades, panels and drums as needed.

Figure 9.9: Channelising Devices and High Level Warning Devices. [9-1]

Barriers are devices designed to prevent vehicular penetration from the traveled way into construction or maintenance areas behind the barrier. A precast concrete safety shape barrier is often used in construction and maintenance work areas.

High level warning devices as shown in Figure 9.9 are used to supplement other controls and devices necessary to alert motorists of construction and maintenance activities or obstructions in the roadway and are designed to be seen over the top of preceding vehicles.

A taper is a series of channeling devices (baricades, cones, drums) and pavement markings placed at an angle to move traffic out of its normal path. The length of the taper used to close a lane is determined by the speed of traffic and the width of the lane to be closed. The formulas for taper length are given in the following table.

If restricted sight distance is a problem (e.g. a sharp vertical curve or horizontal curve) the taper should begin well in advance of the view obstruction. Generally, tapers should be lengthened, not shortened, to increase their effectiveness.

The two-way traffic taper is used in advance of a work area that occupies part of a two-way road in such a way that the remainder of the road is used alternately by traffic in either direction. A short taper is used to cause traffic to slow down by giving the appearance of restricted alignment. One or more flaggers

FORMULAS FOR TAPER LENGTH

Posted Speed	Formula
40 mph or under	$L = WS^2/60$
45 mph and over	$L = WS$

where

L = taper length in feet

W = width of lane or offset in feet

S = posted speed or off peak 85 percentile speed in mph

Speed Limit mph	Taper Length L in feet			Number of Channelizing Devices for Taper*	Spacing of Devices Along Taper in Feet
	Lane Width in Feet				
	10	11	12		
20	70	75	80	5	20
25	105	115	125	6	25
30	150	165	180	7	30
35	205	225	245	8	35
40	270	295	320	9	40
45	450	495	540	13	45
50	500	550	600	13	50
55	550	605	660	13	55

*Based on 12 foot wide lane.

are usually employed to assign right-of-way in such situations. Two-way traffic tapers should be 50 to 100 feet long, with channelizing devices spaced a maximum of 10 to 20 feet, respectively, to provide clear delineation of the taper.

For a shoulder closure taper, one half the length given in the preceding table is suggested as a maximum provided the shoulder is not used as a travel lane due to construction.

The selection and placement of traffic control devices for control of traffic is dependent on the length of time that the road will be occupied by the construction or maintenance activity. The work zone activities can be either moving, mobile or intermittent moving, short term stationary or long term stationary.

A moving work zone is a construction, maintenance or utility work site that is continuously being moved during the period when work is actively in progress. For such activities fixed signing and channelization are not practical. The traffic control devices used will be service vehicle mounted and possibly supplemented by trailer mounted or portable advanced warning signs.

The vehicles used in the work zone should be painted either orange or yellow, and have appropriate warning signs and an operating amber light visible to all approaching traffic for a distance of 1000 feet. The light shall be an amber strobe light or an amber flashing, oscillating or rotating incandescent, direct beam light. Red flags at least 10 feet high may also be mounted on the vehicle. If the vehicle is moving less than 25 mph a slow moving vehicle sign should be displayed. If the vehicle is traveling over 25 mph the sign should be removed or covered.

For moving operations, a separate sign truck (shadow vehicle) with warning signs, flashing lights, and flags follows the work vehicle to warn approaching traffic and to shield the work vehicle. On two-lane two-way roads, a

lead vehicle with signs and lights may also be used. On low volume roads with flat grades and straight alignment, moving operations may be performed without a shadow vehicle however the work vehicle must be equipped with adequate traffic control devices.

Crash attenuators or pads may be mounted on the rear of the shadow vehicle or the work vehicle if no shadow vehicle is used.

For the mobile or intermittent moving operations (15 minutes or less), the traffic control devices would be the same as for moving operations, however, channelizing devices such as cones may be used to guide traffic around the work area. High level warning devices which have excellent visibility and are easily transportable could also be used at these sites.

For short term stationary operations (those work activities that require more than 15 minutes and less than one period of daylight to complete and are not performed during hours of darkness) advanced warning signs would be placed on portable or trailer mounts. Cones would be used for channelizing devices to guide traffic around the work area. High level warning devices could also be used to increase the visibility of the work site.

For long term stationary work zones (those work activities that take longer than one period of daylight to complete or are performed during hours of darkness) more per-

manent mountings are used for signs and type I or II barricades or drums would be used for channelizing traffic around the work area. Steady burning lights would be placed on the barricades and drums for channelizing traffic at night. Flashing lights are used to warn motorists of obstructions in or adjacent to the roadway.

Installation

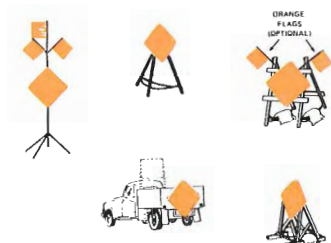
Signs shall be placed in positions where they will convey their messages most effectively. Signs shall be so placed that the motorist will have adequate time for response.

As a general rule signs shall be located on the right-hand side of the street or roadway. Where special emphasis is needed, dual installations may be made which consist of duplicate signs opposite each other on the left and right sides of the roadway. Within a construction or maintenance zone it is often necessary and/or desirable to erect signs on portable supports placed within the roadway itself. It is also permissible to mount appropriate signs on barricades or on work vehicles. See Figure 9.10.

Standards for height and lateral clearance of roadside signs are shown in Figure 9.11.

Single sign supports are usually adequate for signs up to 36" x 36". Larger signs normally require two supports to prevent twisting and turning of the sign assembly. Signs mounted on barricades or temporary supports may be

PORTABLE AND TEMPORARY MOUNTINGS



WING BARRICADES

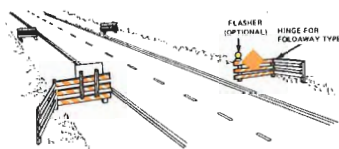


Figure 9.10: Methods of Mounting Signs other than on Posts. [9-1]

at lower heights, but the bottom of the sign shall not be less than one foot above the pavement elevation.

Advance warning signs should be far enough from the work site to give time for the motorist to react to the message on the sign yet close enough to the work site to constantly remind.

Where open highway conditions prevail on the approach to the work site, advance warning signs should be placed approximately 1500 feet in advance of the condition to which they are calling attention. Where a series of advance warning signs are used, the warning sign nearest the work site should be placed approximately 500 feet from the point of restriction with the additional signs at 500 to

1000 foot intervals. On limited access facilities, the advance warning distance should be increased to one-half mile or more. On city streets, where more restrictive conditions prevail on the approach to the work area, signs in the immediate vicinity of the work may be placed at closer spacings.

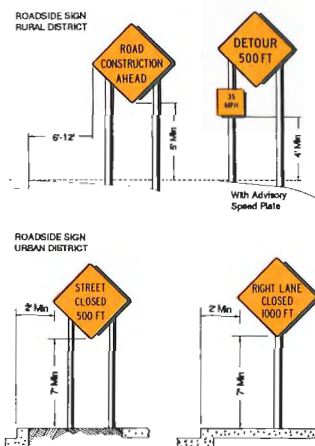


Figure 9.11: Height and Lateral Locations of Signs -- Typical Installation [9-1]

A rule-of-thumb for the spacing between signs in a series is:

250 feet for urban, residential or business districts or with speeds under 40 mph;

500 feet for urban arterials and rural roads or with speeds over 40 mph; and

1000 feet for expressways and freeways.

Traffic control devices should be placed in the order that motorists will see them, starting

with the sign or device that is farthest from the work area. The first traffic control device to be installed is an advance warning sign placed upstream of the work area. From this starting point other signs, cones, barricades and devices are set up with the flow of traffic until the work site is reached. Next the work site is barricaded. The end construction sign beyond the work site, is the last sign to be placed.

When one direction of traffic will be directed into opposing traffic lanes, the signs, devices and pavement markings for the opposing traffic should be placed first. When the signs and devices are across from or at the work area, the devices for the oncoming direction can then be set up. It is essential to channelize opposing traffic out of its lane before moving the oncoming traffic into the lane.

The signs and devices would be removed in reverse order in which they were placed.

When signs or channelizing devices are to be installed and removed several times during the work operation, a spot should be painted where the devices are located, so that the installation can be repeated quickly and so that proper placement is assured.

Inspection and Maintenance

Once the traffic control devices have been placed, it is important to make sure they are going to function as planned. Before work begins a drive through the construction or maintenance area during daylight and at

night should be made to check that all traffic control devices are in the proper place, are visible to the motorist and convey the information that is needed by the motorist to safely pass through the work area.

After the work has begun the traffic control layout should be checked from time to time. Checks can be made in the morning before work starts, at noon, in the afternoon following work, and once after dark.

Proper maintenance of the traffic control devices is very important. Dirty signs and channelizing devices must be cleaned. Damaged or missing signs and channelizing devices must be replaced. Channelizing devices that have been displaced by vehicular contact, slip stream from trucks, workers or wind must be replaced in their original position.

Removal

Traffic control devices (signs, channelizing devices, pavement markings) that are not applicable because either work has not started yet or work has been finished or a change has been made in the traffic control pattern must be either removed, securely covered or turned so that they do not face traffic. Signs that are no longer applicable and are covered must be covered with an opaque material. Burlap or other materials that are not opaque are not acceptable. At night, non-opaque materials let the messages be seen because headlights reflect the message through the material.

Methods for pavement marking removal include grinding, burning, chemical treatment, sandblasting, hydroblastic, and high pressure water jetting. Overpainting markings, which are no longer appropriate, with black paint or bituminous solutions is not allowed by the *Manual on Uniform Traffic Control Devices*.

Documentation

Traffic control actions taken in the field should be recorded. Documentation should include:

- starting and ending time of work
- location of work
- type, condition and position of traffic control devices
- names of personnel
- types of equipment used and
- any change in temporary or permanent regulatory devices.

Several methods of recording traffic control can be used. These include:

- photologging
- photographs either keyed to a diary or containing a brief description of time, location, direction, and photographer's name
- special notes on construction plans
- daily diary entries of times, locations, and names of individuals involved in the installation, change, and removal of traffic control devices

Change orders or work orders should be keyed to the diary when used. Routine inspections should be performed and documented. When inspections reveal a condition that requires correction, documentation should include:

- description of correction needed, when it was noted and by whom
- corrections made or deferred and why
- replacements made or deferred and why
- any other needed actions

Instructions to contractors and subcontractors should be recorded.

In case of an accident, the circumstances and relevant factors should be promptly recorded and documented. Photographs of the site are recommended.

Flagging

Flaggers should only be used when required to control traffic or when all other methods of traffic control are inadequate to warn and direct motorists. Flaggers are responsible for the safety of traffic and workers. They should be alert, have good eyesight, quick reflexes, and a thorough understanding of their job. For short work areas where both ends can be seen at the same time one flagger may be adequate. Both directions of traffic must be able to see the flagger and to recognize the person as a flagger. On longer work areas, two or more flaggers are often needed.

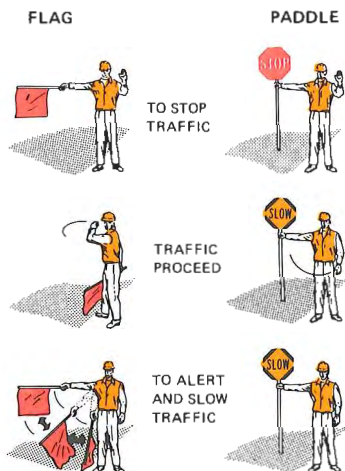


Figure 9.12: Use of Hand Signaling Devices by Flagger. [9-1]

Flaggers are required to wear orange or fluorescent orange clothing such as a vest, shirt or jacket. The wearing of an orange hard hat is recommended. For night time conditions, similar garments shall be reflectorized and a floodlighted flagger's station is recommended. Flaggers may use either a red 24" flag or a reflectorized 18" STOP-SLOW paddle. The paddle is recommended over the flag. The standard signals to be used by flaggers are shown in Figure 9.12. Flaggers should be visible, should always face traffic and should be prepared to warn workers to get out of the way if necessary.

Flaggers stations shall be located far enough in advance of work site so that approaching traffic will have sufficient distance to reduce speed before entering the project, usually 200 to 300 feet is desirable. In urban areas when

speeds are low and streets closely spaced, the distance necessarily must be decreased.

The flagger should stand either on the shoulder adjacent to the traffic being controlled or in a barricaded lane. At a spot obstruction a position may have to be taken on the shoulder opposite the barricaded section. Under no circumstances should a flagger stand in a lane being used by moving traffic.

Whenever a flagger is on duty, the advance flagger sign should be displayed to traffic. When a flagger is not on duty, the sign should be removed or covered.

Examples

The following illustrations (Figures 9.13 through 9.29) are examples of layouts for two-lane two-way roadways. The *Manual on Uniform Traffic Control Devices* states "No one standard sequence of signs or other control devices can be set up as an inflexible arrangement for all situations due to the variety of conditions encountered." These examples taken from the MUTCD and other publications are the minimum desirable layouts for normal situations. Additional protection must be provided when special complexities and hazards are present. There is a need to recognize the physical and traffic operational characteristics of each individual construction or maintenance work area when developing the traffic control plan for use of the various traffic control devices (signs, pavement markings, channelizing devices) at the work site.

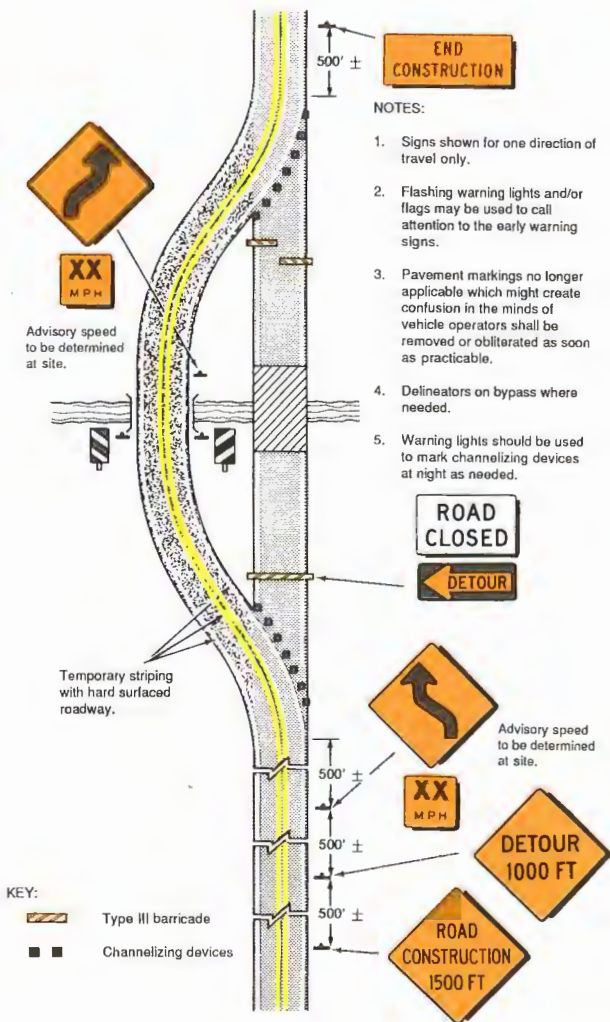


Figure 9.13: Typical Applications of Traffic Control Devices on a Two-lane Highway Where the Entire Roadway is Closed and a Bypass Detour is Provided. [9-1]

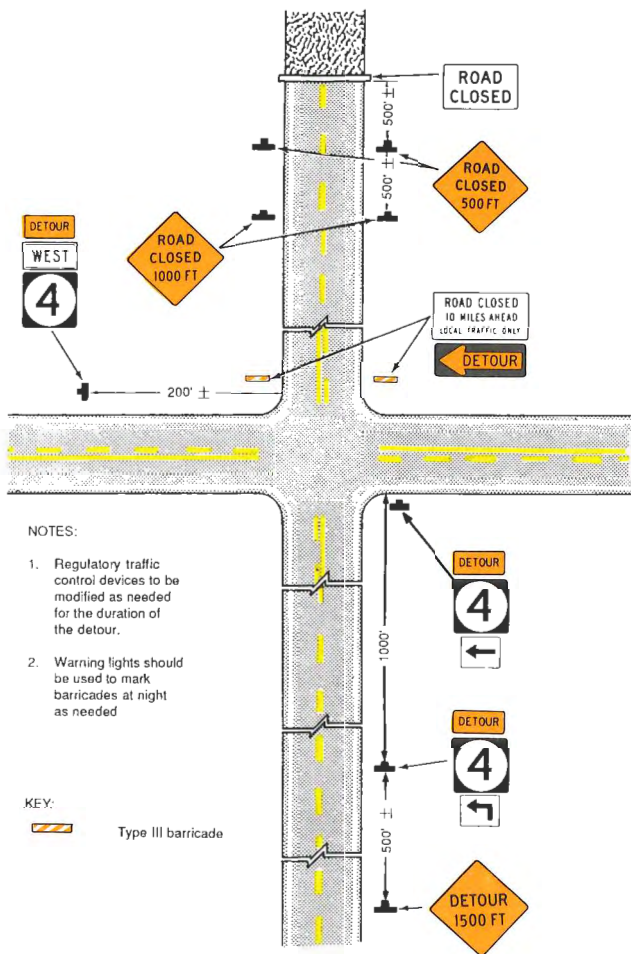


Figure 9.14: Typical Application -- Roadway Closed Beyond Detour Point. [9-1]

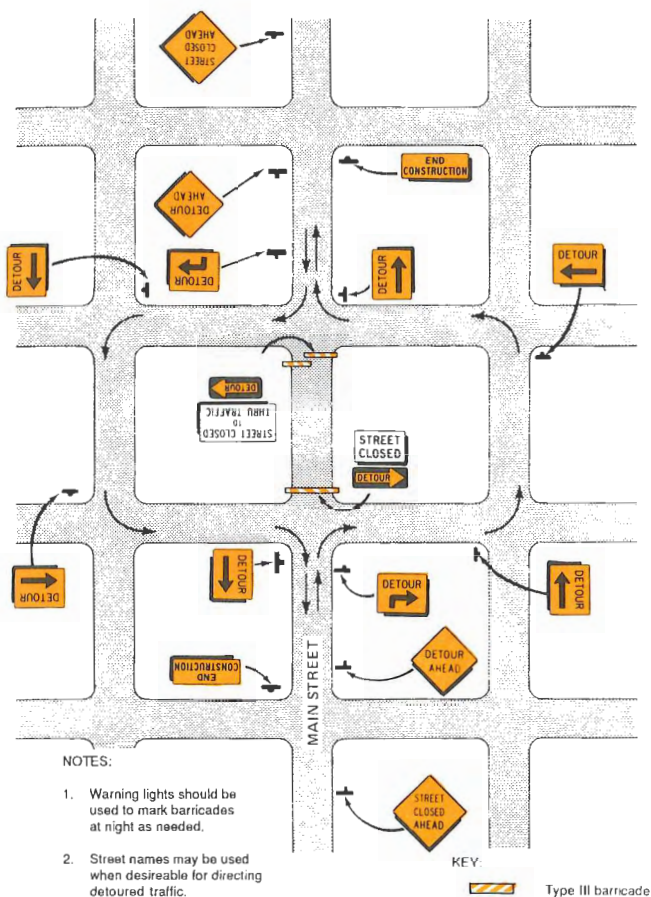


Figure 9.15: Typical Application -- Detour Signing for Street Construction Project in a Street Grid. [9-1]

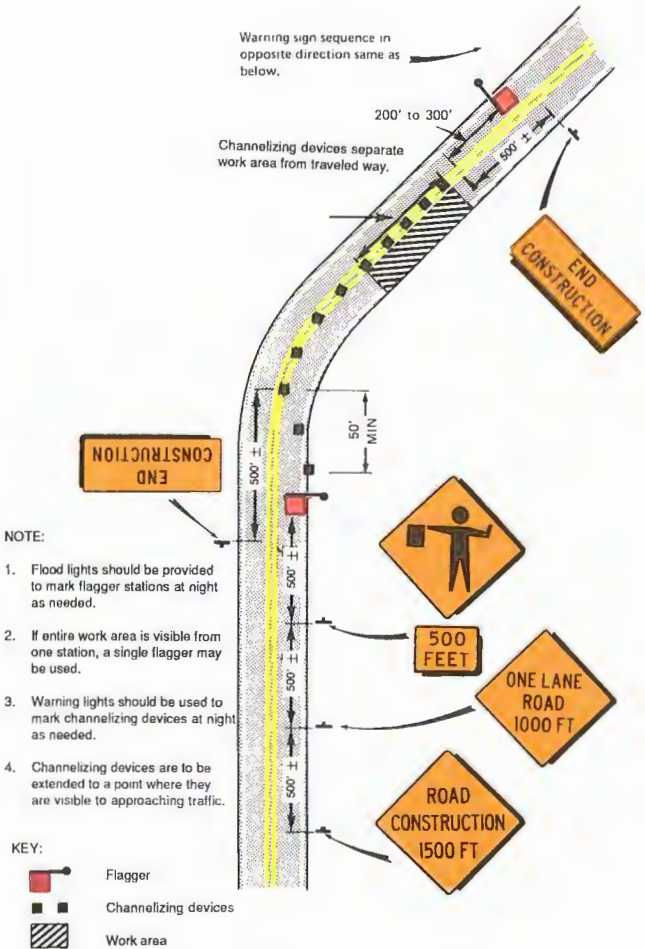


Figure 9.16: Typical Applications of Traffic Control Devices on Two-lane Highway Where One Lane is Closed and Flagging is Provided. [9-1]

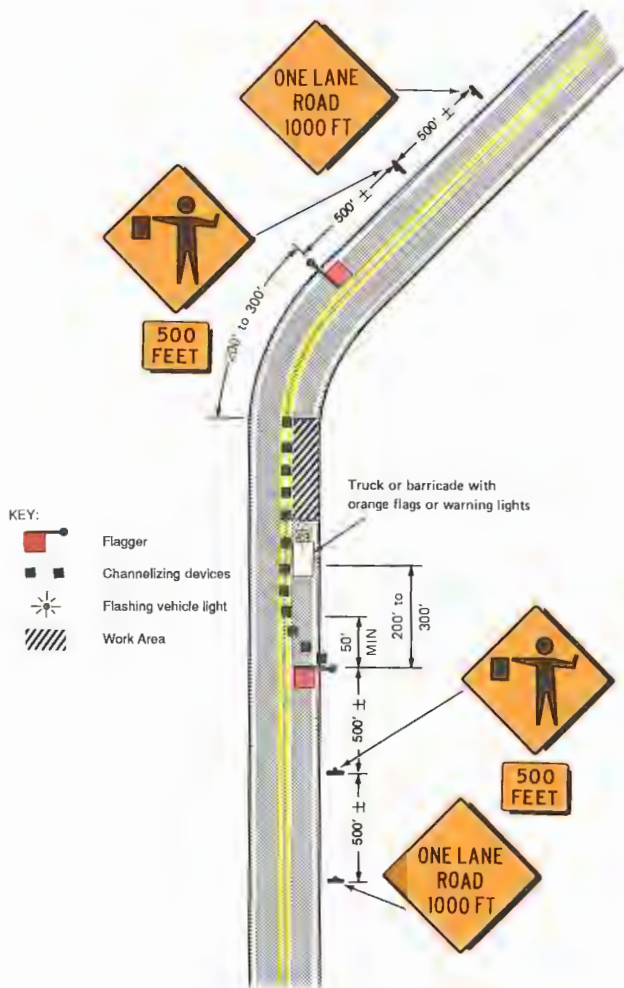


Figure 9.17: Typical Application -- Daytime Maintenance Operations of Short Duration on a Two-lane Roadway and Flagging is Provided. [9-1]

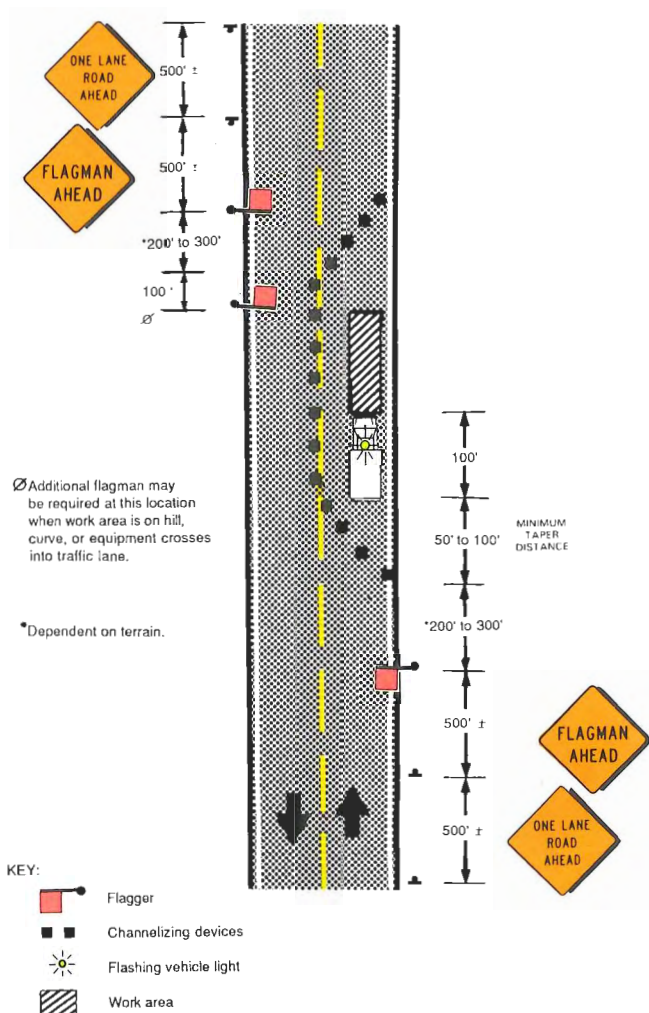


Figure 9.18: Two Lane Highway -- One Lane Obstructed (more than 30 minutes). [9-5]

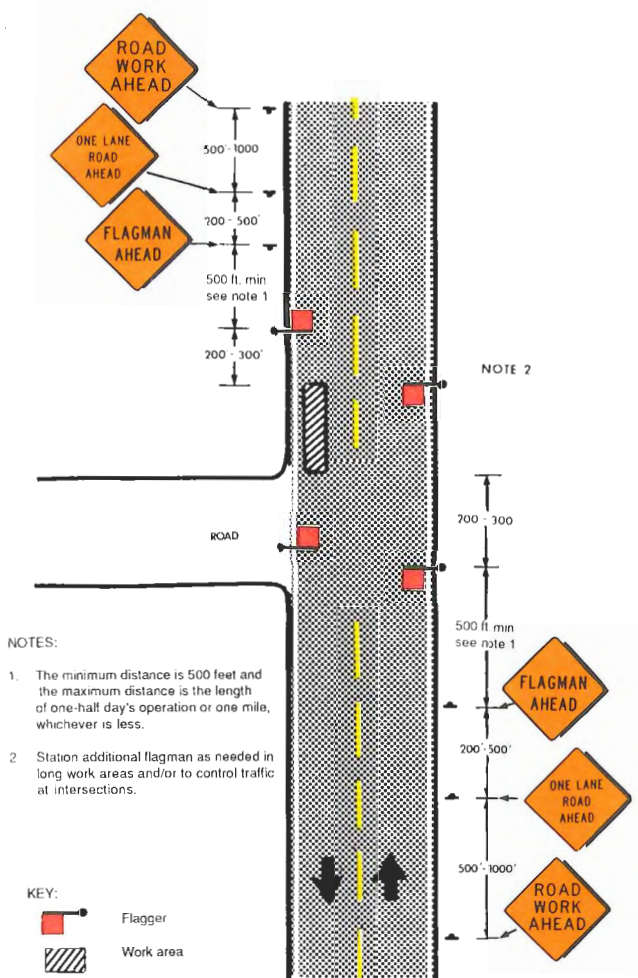


Figure 9.19: Two Lane Highway -- One Lane Obstructed -- Extended Work Zone. [9-5]

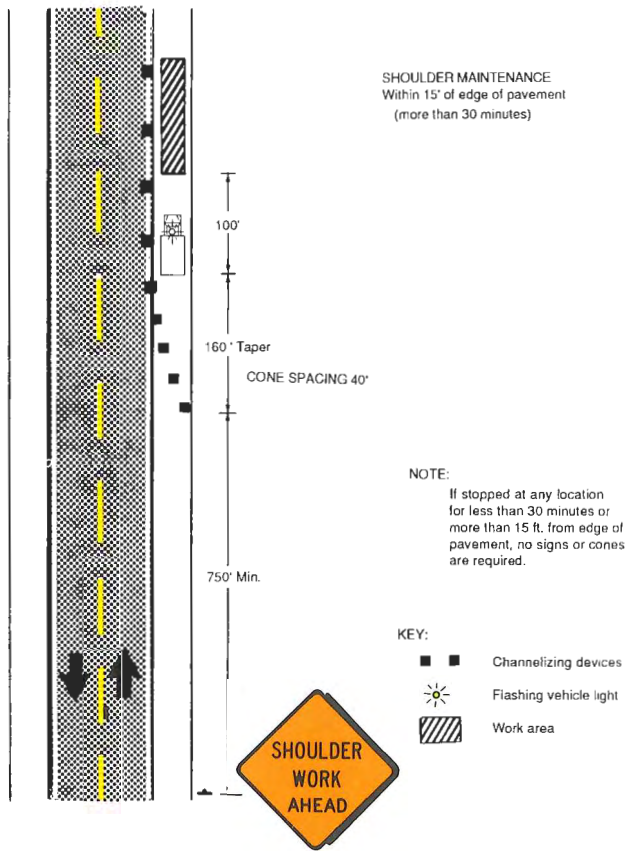


Figure 9.20: Two Lane Highway -- Shoulder Maintenance. [9.5]

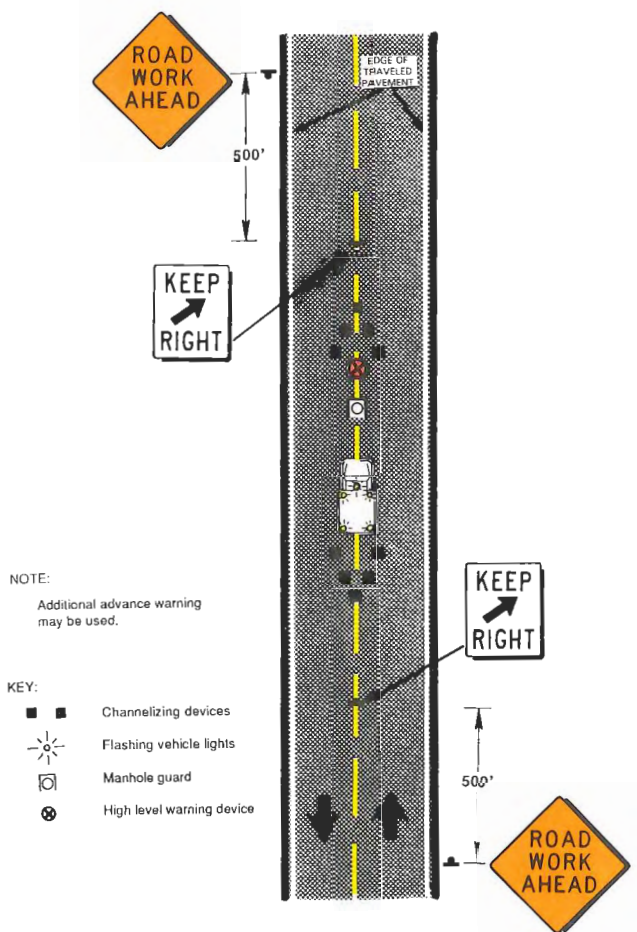


Figure 9.21: Typical Application of Traffic Control Devices for a Short-term Utility Operation in an Urban Location. [9-2]

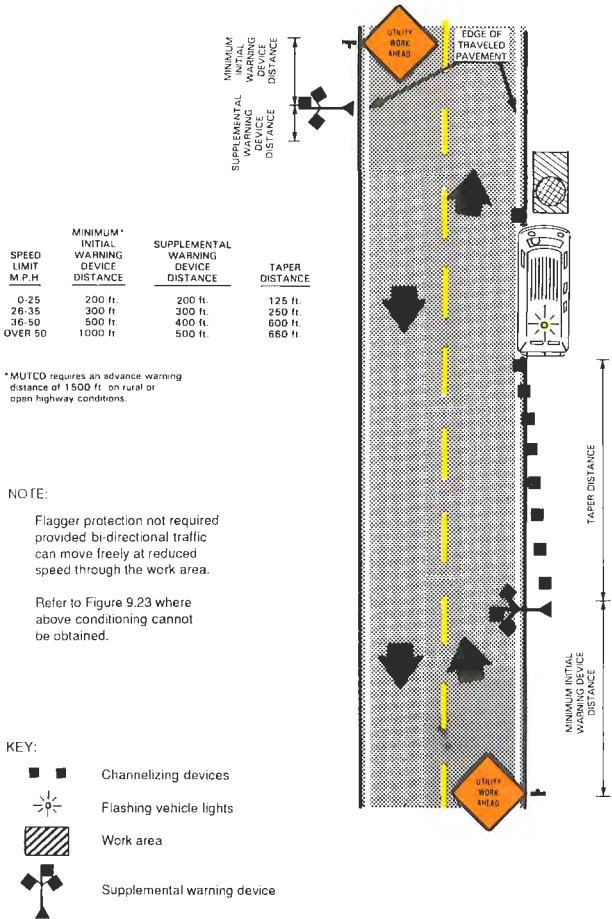


Figure 9.22: Typical Application for a Utility Work Zone on a Two-lane Roadway with Low Traffic Volume. [9-2]

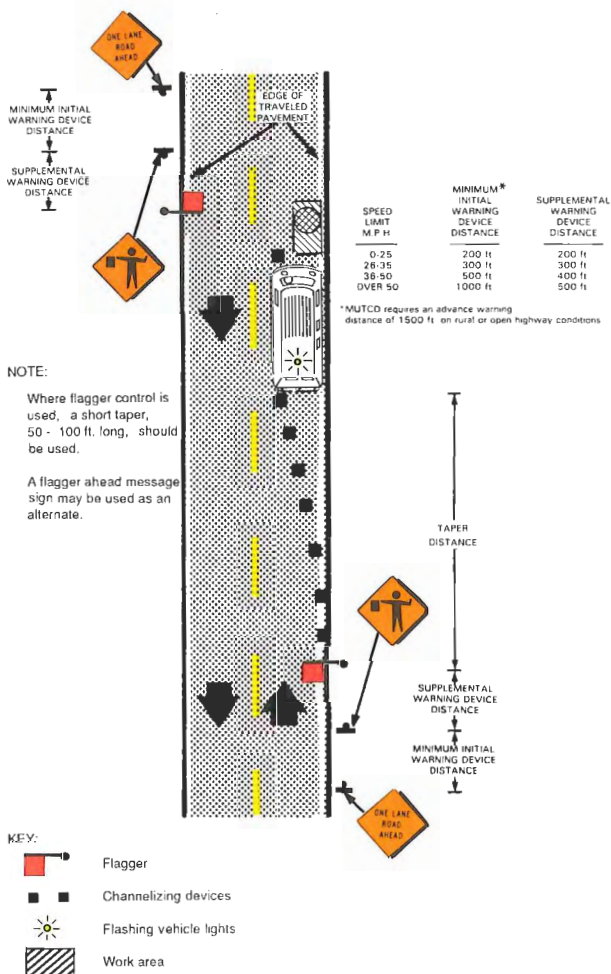
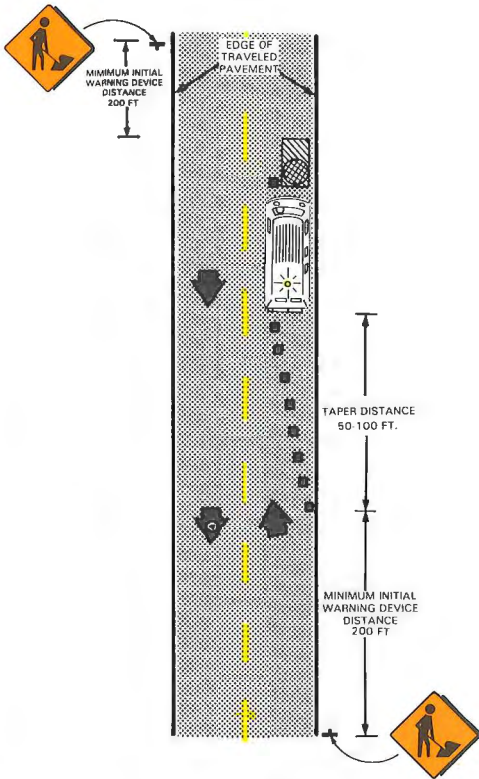


Figure 9.23: Typical Application for a Utility Work Zone on a Two-lane Roadway. [9-2]



NOTES:

Where a flagger is required because of traffic volume or visibility, refer to Figure 9.23 for set-up.

With very few exceptions, this control device set-up is not to be used in rural areas. Typical applications of traffic control devices on other roadways are shown on figures 9.22 and 9.23

KEY:




-  Channelizing devices
-  Flashing vehicle light
-  Work Area

Figure 9.24: Typical Application for a Utility Work Zone on a Two-lane Residential Street (Low Traffic Volume). [9-2]

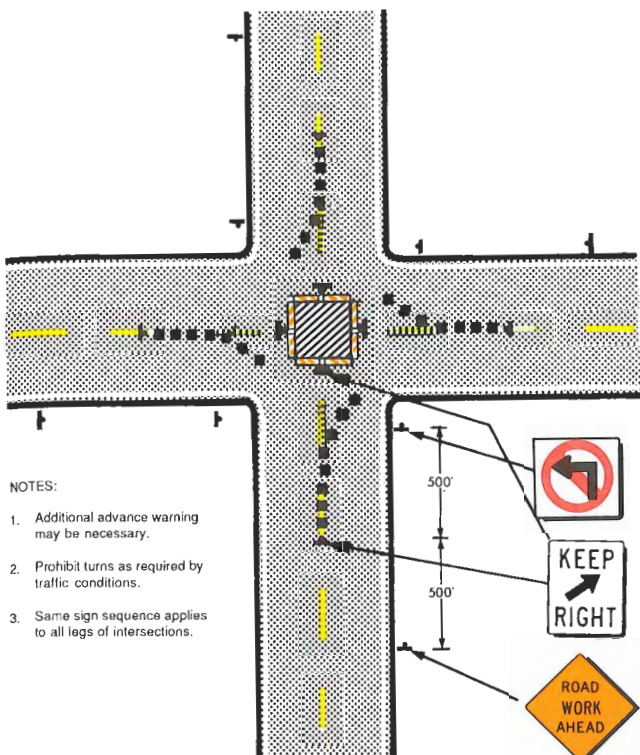
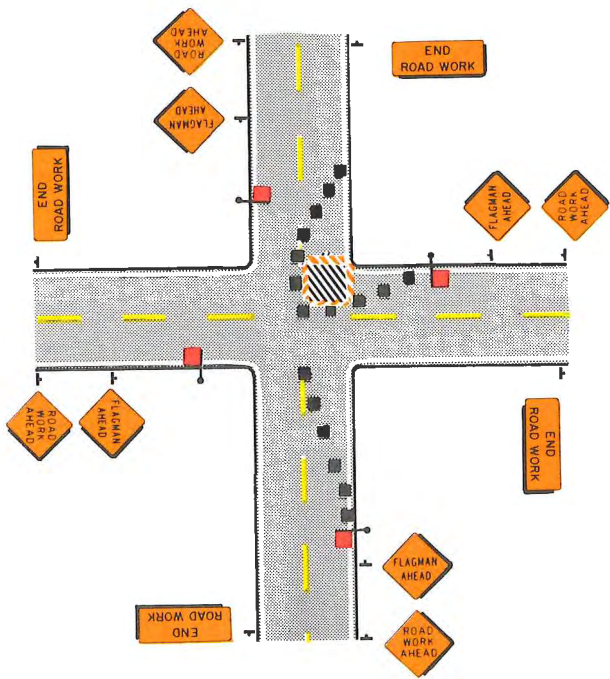


Figure 9.25: Typical Application of Traffic Control Devices when the Work Area is in the Center of an Intersection. [9-2]



NOTES:

Low volumes (2 lanes), use one flagger at center of intersection.

High volumes (4 lanes), use four flaggers on intersection legs as shown.

"ONE LANE ROAD AHEAD" sign may also be necessary to provide adequate advanced warning.

NOTE FOR NIGHT CLOSURE:

- 1. Flashing lights on signs
- 2. Steady burn lights for delineation and channelization

KEY:



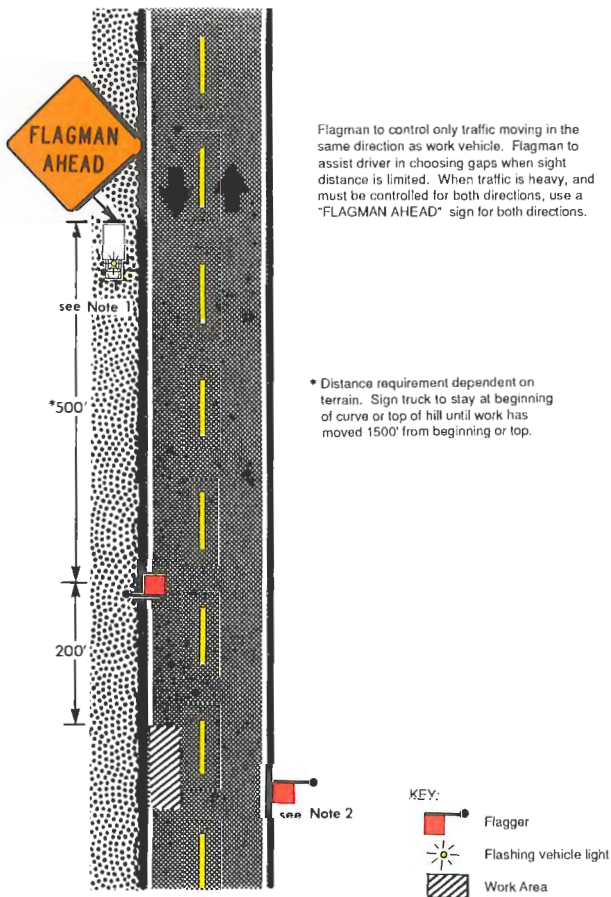
-  Flagger
-  Channelizing devices
-  Work Area
-  Type III barricades

Figure 9.26: Flagger Control for Intersection Lane Closure. [9-4]



NOTES:

1. If shoulder restricts getting truck off pavement, use tripod standard. Distance to standard should be minimum 500', maximum 1 mile.
2. Alternate location of flagman on low volume roads or if work area on curve.

Figure 9.27: Two Lane Highway -- One Lane Obstructed (less than 30 minutes). [9-5]

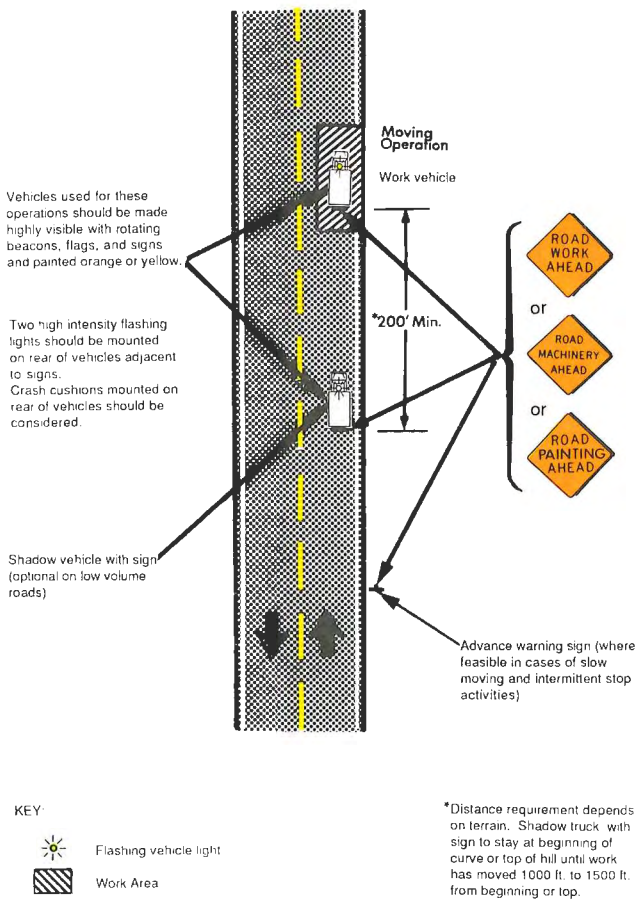


Figure 9.28: Two Lane Highway -- One Lane Obstructed -- Moving Operation. [9-5]

NOTES:

1. With this type of control, the work and shadow vehicles should pull over frequently to allow traffic to pass.
2. The distance between the work and shadow vehicles may vary according to terrain, paint drying time and other factors.
3. Additional shadow vehicles to warn and reduce speed of oncoming traffic may be used.
4. Another method for traffic control is to perform edge striping from the shoulders and to place the center line with the work and shadow vehicles directly over the centerline.
5. Crash cushions mounted on the rear of the vehicles should be considered.
6. Two high-intensity flashing lights should be mounted on rear of vehicles adjacent to sign.

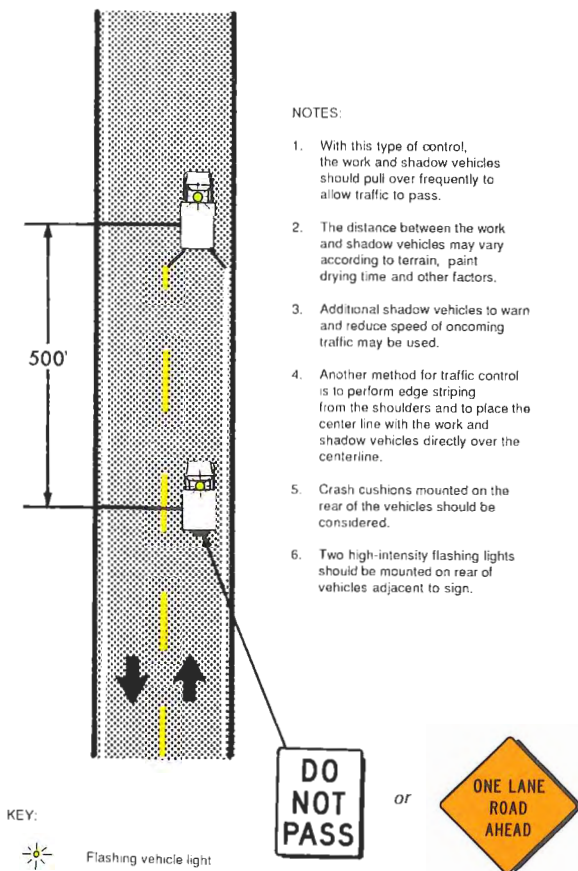


Figure 9.29: Typical Application -- Using a Shadow Vehicle for Advance Warning. [9-2]

Bibliography

- [9-1]. Indiana Department of Highways, *Indiana Manual on Uniform Traffic Control Devices for Streets and Highways*, 1981.
- [9-2]. Federal Highway Administration, U.S. Department of Transportation, *Work Zone Traffic Control, Standards and Guidelines*, 1985 Edition (Part VI, Traffic Controls for Street and Highway Construction and Maintenance Operations of the Manual on Uniform Traffic Control Devices and Part VI, Work Zone Traffic Control of the Traffic Control Devices Handbook).
- [9-3]. Federal Highway Administration, U.S. Department of Transportation, Franklin, J. D. et. al, *Traffic Controls in Construction and Maintenance Work Zones*, Volume 1, Office Function, FHWA-TS-77-204, May 1977.
- [9-4]. Federal Highway Administration, U.S. Department of Transportation, Franklin, J. D. et. al, *Traffic Controls in Construction and Maintenance Work Zones*, Volume II, Field Function, FHWA-TS-77-203, May 1977.
- [9-5]. Indiana Department of Highways, Division of Maintenance, *Worksite Traffic Control Manual for Daylight Maintenance and Traffic Operations*, June 1981.
- [9-6]. J. W. Hall and J. D. Brogan, *Construction and Maintenance Area Traffic Control Short Course Notes*, University of New Mexico, June 1984.

Notes

